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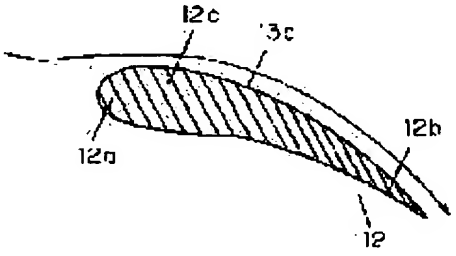
(71)Applicant : MATSUSHITA REFRIG CO LTD
(72)Inventor : KIDA TAKUMI
SUZUKI SOUZOU
YABUSHITA AKIHIRO

(54) BLOWER IN AIR CONDITIONER ETC.

(57)Abstract:
PROBLEM TO BE SOLVED: To suppress both blowing noises from a blower and fluid noises generated from a fan guard in a blower adopted to an air conditioner or the like by suppressing large peel-off of air flow at a negative pressure surface of a vane, and also suppressing a speed increase of a discharged air flow.
SOLUTION: A sectional shape of a vane 12 at its same diameter cylindrical section on the hub side 12c is rounded on the side of a front edge 12a to form a wing-like shape. A sectional area of the vane 12 at its same diameter cylindrical section on the outer peripheral side is evenly thin. It is thus possible to prevent large peel-off of air inflow from the front edge 12a, and increase of discharged air velocity from a discharge side 12b of the vane 12. It is also possible to suppress turbulance of discharged air flow when it passes a linear nember of a tan guard. It is possible to suppress both blowing noises due to peel-off on the negative pressure surface side of the vane 12 and fluid noises generated from the fan guard.



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CLAIMS

[Claim(s)]
[Claim 1] Blowers, such as a motor, a hub attached in said motor, an impeller which consists of two or more wings prepared in the perimeter of said hub, an orifice surrounding the periphery of said impeller, and an air conditioner which consisted of fan guards prepared in the discharge side, made the profile the blade-section configuration by the side of the hub of said wing, and made the blade-section configuration by the side of the periphery of said wing plate-like [of thin meat], or the shape of a profile of thin meat.
[Claim 2] Blowers, such as an air conditioner according to claim 1 which prepared the dimple of two or more abbreviation semi-sphere configurations in the suction-surface side by the side of the periphery of a wing.
[Claim 3] Blowers, such as an air conditioner according to claim 1 which prepared two or more Librettos in the suction-surface side by the side of the periphery of a wing.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the blower used for the air conditioner currently used in the field broad from home use to business use.
[0002]
[Description of the Prior Art] In recent years, the exterior unit of an air conditioner is in the

inclination for it to be installed in various locations and for silence of the air blasting noise to be desired more, with diversification of a building situation.
[0003] There are some which are shown in JP,5-321982,A as a blower used for the exterior unit of the conventional air conditioner etc.
[0004] Hereafter, the axial flow mold blower used for the exterior unit of the conventional air conditioner mentioned above is explained, referring to a drawing.
[0005] Drawing 13 - drawing 16 show the structure of the exterior unit of the conventional air conditioner, and a blower.
[0006] In drawing 13 - drawing 16 , 1 is the body of the exterior unit of an air conditioner, 2 is a box, 3 is the heat exchanger prepared in the box 2, 4 is the compressor formed in the box 2, 5 is the blower of the axial flow mold formed in the reverse field the air-drawing side of the heat exchanger 3 in a box 2, and 6 is the fan guard prepared in the discharge side of the axial flow mold blower 5.
[0007] 7 is the motor of an axial blower 5, 8 is the impeller which arranged two or more wings 10 in the perimeter of installation and hub 8a for hub 8a at the motor 7, and 9 is an orifice surrounding the perimeter of an impeller 7.
[0008] Two or more wings 10 are profiles to which it applies to 10d a periphery side from hub side 10c, and the cross-section configuration of the wing 10 in the cylinder cross-section development view (drawing 15 R> 5, drawing 16) of the same radius has a radius of circle in wing 10 first-transition 10a.
[0009] The actuation is explained below about the exterior unit of the air conditioner constituted as mentioned above, and a blower.
[0010] First, in case the air inhaled from the air-drawing side of a heat exchanger 3 passes a heat exchanger 3, from a compressor 4, heat exchange of it is carried out to the refrigerant sent to the heat exchanger 3, and it carries out a temperature change. The air which carried out the temperature change is that a motor 7 rotates an impeller 8 to a predetermined hand of cut, is inhaled by the blower 5 of the axial flow mold formed in the field of objection by the side of air drawing of the heat exchanger 3 of a box 2, and blows off from a blower 5 out of a box 2 through the fan guard 6.
[0011] Here, in case a heat exchanger 3 is passed, an inflow air current [as opposed to / turbulence and since an impeller 8 absorbs as it is / first transition 10a of a wing 10 in the flow of air] serves as instability. However, since the wing 10 forms in first transition 10a the profile which has a radius of circle, even if the fluid inlet angle of an inflow air current and the inlet angle of first transition are not in agreement in first transition 10a, big exfoliation is not caused by suction-surface side 11 of first transition 10a, but promotion is suppressed for the exfoliation from first transition 10a by suction-surface side 11 of a wing 10, the increment in turbulence is suppressed, and degradation of the air blasting engine performance of a blower 5 and the increment in the noise are suppressed.
[0012]
[Problem(s) to be Solved by the Invention] In the blower used for the exterior units of this air conditioner In the wing 10 of an impeller 8, an internal air current to 10d a periphery side according to the centrifugal force by revolution A bias, It becomes inflow flow unstable to the pan whose fluid inlet angle is not stable in hub side 10c. Although the effectiveness of the profile which has a radius of circle in first transition 10a of a wing 10 is demonstrated more and exfoliation by suction-surface side 11c of a wing 10 is suppressed when the fluid inlet angle of the inflow air current in first transition 10a in hub side 10c becomes smaller than the design inlet angle of first transition 10a Since it becomes the inflow flow which inflow air currents gathered by 10d the periphery side of a wing 10, and was stabilized mostly Since the fluid inlet angle of the inflow air current in first transition 10a and the design inlet angle of first transition 10a do not change greatly by 10d a periphery side with optimization of a 10d inlet blade angle a periphery side, The exfoliation improvement effect of a profile is small, and an operation of a profile accelerates the about 11d rate of flow the suction-surface side of a wing 10 (accelerating to homogeneity thin meat), and it is breathed out out of an impeller 8 from discharge-side 10b of a wing 10.

[0013] The periphery side of a wing 10 from the first however, in 10d The kinetic energy which an internal air current gives to 10d according to the centrifugal force by revolution, and it gives to an air current by the wing 10 a periphery side since peripheral speed is still quicker, a bias and greatly A sake, In case a regurgitation air current passes the fan guard's 6 wire rod quickly (not shown) substantially compared with hub side 10c, the fluid noise generates the rate of flow of the air current which carries out the regurgitation from a wing 10 from the fan guard 6 of the back wash whose turbulence of a regurgitation air current is 10d the periphery side of a wing 10 greatly.
[0014] Turbulence of the regurgitation air current at the time of accelerating further the regurgitation air current of discharge-side 10b of a wing 10, when it accelerates the about 11d rate of flow the suction-surface side of a wing 10 in 10d, since the cross-section configuration of a wing 10 is a profile, and a regurgitation air current passing the fan guard's 6 wire rod becomes still larger the periphery side of this to the wing 10, and the fluid noise from the fan guard 6 of 10d back wash increases the periphery side of a wing 10.
[0015] Therefore, although the increment in the air blasting noise independent [blower 5] is suppressed by profile-izing the wing 10 of an impeller 8, the fluid noise from the fan guard 6 increases, and the noise increases to reverse as an exterior unit 1 of an air conditioner. Therefore, in blowers, such as an air conditioner, while suppressing the big exfoliation by the side of a wing suction surface and suppressing the increment in the air blasting noise of a blower, it is required that the increment in the fluid noise generated from a fan guard should also be suppressed.
[0016] In blowers, such as an air conditioner, this invention aims at suppressing accelerating of a regurgitation air current and suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise of a blower while it prevents big exfoliation in a wing suction surface.
[0017]
[Means for Solving the Problem] By this invention's making a profile the blade-section configuration by the side of the hub of the wing of an impeller, and making the blade-section configuration by the side of the periphery of a wing into plate-like [of thin meat], or the shape of a profile of thin meat, in order to solve this technical problem As opposed to the unstable inflow flow by which a fluid inlet angle is not stabilized at a hub side because an internal air current inclines toward a periphery side according to the centrifugal force by revolution The effect to which the regurgitation flow which the effectiveness of the profile which has a radius of circle in a blade leading edge was demonstrated more, and suppressed the big exfoliation by the side of the suction surface of a wing, and the profile accelerated by the suction-surface side since peripheral speed was also small makes turbulence increase with a fan guard also becomes small far compared with a periphery side.
[0018] Moreover, since it becomes the inflow flow which inflow air currents gathered for the wing periphery side, and was stabilized mostly Since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle, Since flow does not exfoliate greatly in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, it does not accelerate the regurgitation air current of a wing discharge side, and turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large. Therefore, the outdoor blower of the air conditioner which suppresses both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of the wing suction surface of a blower is obtained.
[0019]
[Embodiment of the Invention] The hub where invention of this invention according to claim 1 was attached in the motor and said motor, The impeller which consists of two or more wings prepared in the perimeter of said hub, and the orifice surrounding the periphery of said impeller, Consist of fan guards prepared in the discharge side, and the blade-section configuration by the side of the hub of said wing is made into a profile. Because make the blade-section configuration

by the side of the periphery of said wing into plate-like [of thin meat], or the shape of a profile of thin meat and an internal air current inclines toward a periphery side according to the centrifugal force by revolution The effectiveness of the profile which has a radius of circle in a blade leading edge is demonstrated more to the unstable inflow flow by which a fluid inlet angle is not stabilized in a hub side, and the big exfoliation by the side of the suction surface of a wing is suppressed. Moreover, since peripheral speed is also small, The effect to which turbulence is made to increase with a fan guard also has the far small regurgitation flow which the profile accelerated by the suction-surface side compared with a periphery side.

[0020] Moreover, since it becomes the inflow flow which inflow air currents gathered in the wing periphery side, and was stabilized mostly Since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle, Since flow does not exfoliate greatly in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, it does not accelerate the regurgitation air current of a wing discharge side, and turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large. Therefore, it has an operation of suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of the wing suction surface of a blower.

[0021] Since invention according to claim 2 serves as inflow flow which was blowers, such as an air conditioner according to claim 1 which prepared the dimple of two or more abbreviation semi-sphere configurations in the suction-surface side of the wing by the side of a periphery, and inflow air currents gathered for the wing periphery side, and was stabilized mostly, Since the fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle The flow separation from a suction-surface side front face is enough controlled by operation of the dimple which prepared the wing suction-surface side also in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat. Turbulence of flow is suppressed, and since the rate of flow by the side of the suction-surface close attendants by the side of a wing periphery is not accelerated like a profile configuration, either, the rate of flow of a wing regurgitation air current does not increase, either.

[0022] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced. Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of the wing suction surface of a blower, it has an operation that the fluid noise generated from a fan guard decreases.

[0023] Since invention according to claim 3 serves as inflow flow which was blowers, such as an air conditioner according to claim 1 which prepared Libretto in the suction-surface side of the wing by the side of a periphery, and inflow air currents gathered for the wing periphery side, and was stabilized mostly The fluid inlet angle of the inflow air current in periphery side first transition and the design inlet angle of first transition do not change greatly with optimization of an inlet blade angle. Exfoliation of flow is controlled by the suction-surface side of first transition also in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat. Furthermore, the turbulent sublayer by the side of wing suction-surface close attendants piles up a periphery side according to the centrifugal force of a revolution of an impeller, and a turbulent sublayer does not accelerate according to frictional resistance buildup, but turbulence is also suppressed by Libretto prepared in the suction surface by the side of a wing periphery.

[0024] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced. Therefore, while controlling the increment in the basing-on exfoliation [by the side of the wing suction surface of a blower], and development of turbulent sublayer air blasting noise, it has an operation that the fluid noise generated from a fan guard decreases.

[0025]

[Example] Hereafter, the example of this invention is explained using drawing 1 - drawing 12 .

[0026] In addition, in order to avoid duplication about the part of the same configuration as the conventional example, the same sign is attached and explanation is omitted.
[0027] (Example 1) Drawing 1 - drawing 5 show blowers, such as an air conditioner of the example of this invention. They are two or more wings by which 12 was prepared in the perimeter of hub 8a of an impeller 8 in drawing 1 - drawing 5 . It is the profile to which the cross-section configuration of the wing 12 in the cylinder cross section of the same radius of hub side 12c has a radius of circle in wing 12 first-transition 12a. The cross-section configuration of the wing 12 in a cylinder cross section with a same radius of 12d is tabular [of thin meat] a periphery side. A periphery side from hub side 12c change of the cross-section configuration of the 12d wing 12 If it applies in the radial center of abbreviation from hub side 12c, and thickness of a profile is gradually made thin and it applies to 12d a periphery side from the radial center of abbreviation, it is plate-like [of the thick thin meat of abbreviation homogeneity].
[0028] The air current of the impeller 8 interior to 12d a periphery side according to the centrifugal force according to a revolution of an impeller 8 by this configuration A bias, The effectiveness of the profile which has a radius of circle in first transition 12a of a wing 12 is demonstrated more to the unstable inflow flow by which a fluid inlet angle is not stabilized in hub side 12c, and as drawing 4 shows, the big exfoliation by suction-surface side 13c of a wing is suppressed. Moreover, since peripheral speed is also small, The effect to which turbulence is made to increase with the fan guard 6 also has the far small regurgitation flow which the profile accelerated by suction-surface side 13c compared with 12d a periphery side.
[0029] Moreover, since it becomes the inflow flow which inflow air currents gathered by 12d the periphery side of a wing 12, and was stabilized mostly as drawing 5 shows Since the fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly a periphery side with optimization of the inlet angle of a wing 12, Since flow does not exfoliate greatly by optimization of a design in the plate configuration of 12d thin meat the periphery side of a wing 12 and it does not accelerate the about 13d rate of flow the suction-surface side of a wing 12 It does not accelerate the regurgitation air current of discharge-side 12b of a wing 12, and turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod does not become large.
[0030] Therefore, both increments in the fluid noise generated from the increment and the fan guard 6 of the air blasting noise by suction-surface side of wing 12 of blower 5 13c and the big exfoliation by 13d are suppressed.
[0031] (Example 2) Drawing 6 - drawing 8 show blowers, such as an air conditioner of the example 2 of this invention. In addition, in order to avoid duplication about the part of the same configuration as an example 1, the same sign is attached and explanation is omitted.
[0032] 14 is the dimple of two or more abbreviation semi-sphere configurations prepared in 13d the 12d suction-surface side the periphery side from the radial center of abbreviation of a wing 12.
[0033] Since it becomes the inflow flow which inflow air currents gathered for 12d the periphery side of a wing 12, and was mostly stabilized by this configuration as drawing 8 showed The fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly the periphery side of a wing 12 with optimization of the inlet angle of a wing 12. Since the flow separation from a 13d front face is controlled by operation of two or more dimples 14 a suction-surface side in 13d the suction-surface side of a wing 12 also in the plate configuration of the thin meat of 12d of peripheries of a wing 12 Since turbulence of flow is suppressed and the about 13d rate of flow is not accelerated the suction-surface side of a wing 12 like [in the case of the cross-section configuration of the profile of a wing 12], either, the rate of flow of a 12d regurgitation air current does not increase the periphery side of a wing 12, either.
[0034] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod is reduced. Therefore, control of the increment in the air blasting noise by suction-surface sides [of the wing 12 of a blower 5 / 13c and 13d]

exfoliation reduces the fluid noise generated from the fan guard 6.
[0035] (Example 3) Drawing 9 - drawing 12 show blowers, such as an air conditioner of the example 3 of this invention. In addition, in order to avoid duplication about the part of the same configuration as an example 1, the same sign is attached and explanation is omitted.
[0036] 15 is two or more Librettos (fluting to a hand of cut) prepared in 13d the 12d suction-surface side the periphery side from the radial center of abbreviation of a wing 12.
[0037] Since it becomes the inflow flow which inflow air currents gathered for 12d the periphery side of a wing 12, and was mostly stabilized by this configuration as drawing 12 showed The fluid inlet angle of the inflow air current in 12d first transition 12a and the design inlet angle of first transition 12a do not change greatly the periphery side of a wing 12 with optimization of the inlet angle of a wing 12. With Libretto 15 which exfoliation of flow was controlled by 13d the suction-surface side of first transition 12a, and was further prepared in 13d the suction-surface side also in the plate-like blade-section configuration of the thin meat of 12d of peripheries of a wing 12 Since it controls that an about 13d turbulent sublayer piles up 12d a periphery side the suction-surface side of the wing 12 by the centrifugal force of a revolution of an impeller 8, and a turbulent sublayer progresses according to buildup of frictional resistance The regurgitation air current from discharge-side 12b of a wing 12 does not accelerate like [in case a wing 12 is a profile configuration], but turbulence is also suppressed.
[0038] Therefore, turbulence of the regurgitation air current at the time of a regurgitation air current passing the fan guard's 6 wire rod is reduced. Therefore, while controlling the increment in the air blasting noise by suction-surface sides [of the wing 12 of a blower 5 / 13c and 13d] exfoliation, and the increment in the air blasting noise according to development of a 13d turbulent sublayer a 12d suction-surface side the periphery side of a wing 12, the fluid noise generated from the fan guard 6 decreases.
[0039]
[Effect of the Invention] Since the air current inside an impeller inclines toward the periphery side of a wing according to the centrifugal force by revolution of an impeller as mentioned above according to this invention, The big exfoliation by the side of the suction surface of a wing is suppressed to the unstable inflow flow by which a fluid inlet angle is not stabilized in a hub side according to the effectiveness of the profile which has a radius of circle in a blade leading edge. Moreover, since peripheral speed is also small, The effect to which turbulence is made to increase with a fan guard also has the far small regurgitation flow by the side of the suction surface by profile-izing which accelerated compared with a periphery side.
[0040] Moreover, in a periphery side, since flow does not exfoliate greatly by optimization of an inlet blade angle in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat since it becomes the inflow flow which inflow air currents gathered and was stabilized mostly, and it does not accelerate the rate of flow by the side of wing suction-surface close attendants, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod does not become large.
[0041] Therefore, the advantageous effectiveness of suppressing both increments in the fluid noise generated from the increment and fan guard of the air blasting noise by the big exfoliation by the side of a wing suction surface is acquired.
[0042] Moreover, the flow separation from a suction-surface side front face is controlled by operation of a dimple by the wing suction-surface side at a periphery side also in the blade-section configuration of plate-like [of thin meat], or the shape of a profile of thin meat, turbulence of flow is suppressed, and since the rate of flow by the side of wing suction-surface close attendants is not accelerated like a profile configuration, either, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced.
[0043] Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of a wing suction surface, the advantageous effectiveness that the fluid noise generated from a fan guard decreases is acquired.
[0044] Moreover, since exfoliation of flow is controlled by optimization of a design by the suction-surface side of first transition at a wing periphery side also in the blade-section

configuration of plate-like [of thin meat], or the shape of a profile of thin meat and it controls that a turbulent sublayer progresses further with Libretto prepared in the suction-surface side of the wing periphery section, turbulence of the regurgitation air current at the time of a regurgitation air current passing a fan guard's wire rod is reduced.
[0045] Therefore, while controlling the increment in the air blasting noise by the exfoliation by the side of a wing suction surface, and development of a turbulent sublayer, the advantageous effectiveness that the fluid noise generated from a fan guard decreases is acquired.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The sectional view of blowers, such as an air conditioner in the example 1 of this invention
[Drawing 2] The front view of blowers, such as an air conditioner in the example 1 of this invention
[Drawing 3] The X-X sectional view of blowers, such as an air conditioner in the example 1 of this invention
[Drawing 4] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 1 of this invention
[Drawing 5] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 1 of this invention
[Drawing 6] The front view of blowers, such as an air conditioner in the example 2 of this invention
[Drawing 7] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 2 of this invention
[Drawing 8] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 2 of this invention
[Drawing 9] The front view of blowers, such as an air conditioner in the example 3 of this invention
[Drawing 10] The X-X sectional view of blowers, such as an air conditioner in the example 3 of this invention
[Drawing 11] The hub side (A-A) cylinder cross-section development view of blowers, such as an air conditioner in the example 3 of this invention
[Drawing 12] The periphery side (B-B) cylinder cross-section development view of blowers, such as an air conditioner in the example 3 of this invention
[Drawing 13] The sectional view of the exterior unit of the conventional air conditioner
[Drawing 14] The front view of the blower used for the exterior unit of the conventional air conditioner
[Drawing 15] The hub side (A-A) cylinder cross-section development view of the outdoor blower of the conventional air conditioner

[Drawing 16] The periphery side (B-B) cylinder cross-section development view of the outdoor blower of the conventional air conditioner

[Description of Notations]

5 Blower
6 Fan Guard
7 Motor
8 Impeller
8a Hub
9 Orifice
12 Wing
12c Hub side
12d Periphery side
13c, 13d Suction-surface side
14 Dimple
15 Libretto

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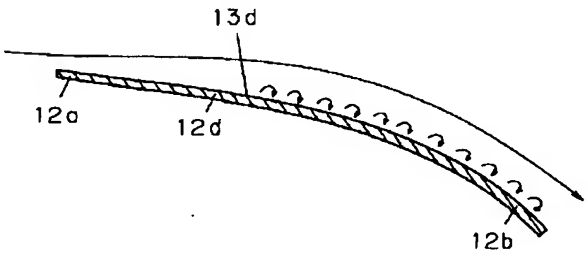
DRAWINGS

[Drawing 5]

12d 外周側
13d 負圧面側



[Drawing 7]

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(71)出願人　000004488
松下冷機株式会社
大阪府東大阪市高井田本通４丁目２番５号

(72)発明者　木田　琢己
大阪府東大阪市高井田本通４丁目２番５号
松下冷機株式会社内

(72)発明者　鈴木　創三
大阪府東大阪市高井田本通４丁目２番５号
松下冷機株式会社内

(72)発明者　薮下　明弘
大阪府東大阪市高井田本通４丁目２番５号
松下冷機株式会社内

(74)代理人　弁理士　滝本　智之　（外１名）

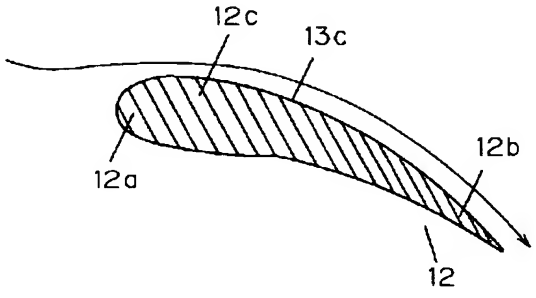
(54)【発明の名称】　空気調和機等の送風機

(57)【要約】

【課題】　空気調和機等に用いられる送風機において、羽根負圧面での大きな剥離を防ぐと共に、吐出気流の増速を抑え、送風機の送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える。

【解決手段】　羽根１２のハブ側１２ｃの同一半径の円筒断面における羽根１２の断面形状が羽根１２前縁１２ａに丸みを持つ翼型とし、外周側の同一半径の円筒断面における羽根１２の断面形状が均一薄肉とすることで、前縁１２ａで流入気流が大きく剥離せず、かつ、羽根１２の吐出側１２ｂからの吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくならない。従って、羽根１２の負圧面側での剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える。

12c　ハブ側
13c　負圧面側



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【特許請求の範囲】

【請求項１】　モータと、前記モータに取り付けられたハブと、前記ハブの周囲に設けられた複数の羽根からなる羽根車と、前記羽根車の外周を囲むオリフィスと、吐出側に設けられたファンガードで構成され、前記羽根のハブ側の羽根断面形状を翼型とし、前記羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型状にした空気調和機等の送風機。

【請求項２】　羽根の外周側の負圧面側に複数の略半球形状のディンプルを設けた請求項１記載の空気調和機等の送風機。

【請求項３】　羽根の外周側の負圧面側に複数のリブレットを設けた請求項１記載の空気調和機等の送風機。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、家庭用から業務用まで幅広い分野で使用されている空気調和機等に用いられる送風機に関するものである。

【０００２】

【従来の技術】近年、建築事情の多様化に伴い、空気調和機の室外機は様々な場所に設置されるようになってきており、より送風騒音の静音化が望まれる傾向にある。

【０００３】従来の空気調和機の室外機等に用いられる送風機としては、特開平５－３２１９８２号公報に示されているものがある。

【０００４】以下、図面を参照しながら、上述した従来の空気調和機の室外機に用いられる軸流型送風機について説明する。

【０００５】図１３～図１６は従来の空気調和機の室外機、及び送風機の構造を示すものである。

【０００６】図１３～図１６において、１は空気調和機の室外機の本体であり、２は箱体であり、３は箱体２内に設けられた熱交換器であり、４は箱体２内に設けられた圧縮機であり、５は箱体２内の熱交換器３の空気吸込側と反対の面に設けられた軸流型の送風機であり、６は軸流型送風機５の吐出側に設けられたファンガードである。

【０００７】７は軸流送風機５のモータであり、８はモータ７にハブ８ａを取り付け、ハブ８ａの周囲に複数の羽根１０を配設した羽根車であり、９は羽根車７の周囲を囲むオリフィスである。

【０００８】複数の羽根１０は、ハブ側１０ｃから外周側１０ｄにかけて、同一半径の円筒断面展開図（図１５、図１６）における羽根１０の断面形状が羽根１０前縁１０ａに丸みを持つ翼型である。

【０００９】以上のように構成された空気調和機の室外機、及び送風機について以下その動作を説明する。

【００１０】まず、熱交換器３の空気吸込側より吸い込まれた空気は、熱交換器３を通過する際に圧縮機４より熱交換器３に送られた冷媒と熱交換し、温度変化する。

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温度変化した空気はモータ７が羽根車８を所定の回転方向に回転することで、箱体２の熱交換器３の空気吸込側の反対の面に設けられた軸流型の送風機５に吸い込まれ、送風機５よりファンガード６を介して箱体２外へ吹き出される。

【００１１】ここで、熱交換器３を通過する際、空気の流れが乱れ、そのまま、羽根車８に吸い込まれるため、羽根１０の前縁１０ａに対する流入気流は不安定となる。しかし、羽根１０が前縁１０ａに丸みを有する翼型を形成しているため、前縁１０ａにおいて流入気流の流入角と前縁の入口角が一致しなくても前縁１０ａの負圧面側１１で大きな剥離を起こさず、羽根１０の負圧面側１１で前縁１０ａからの剥離が助長が抑えられ、乱れの増加が抑えられ、送風機５の送風性能の劣化と騒音の増加を抑える。

【００１２】

【発明が解決しようとする課題】この空気調和機の室外機用に用いられた送風機では、羽根車８の羽根１０において、回転による遠心力により内部の気流は外周側１０ｄに偏り、ハブ側１０ｃでは流入角が安定しないさらに不安定な流入流れとなり、ハブ側１０ｃにおける前縁１０ａでの流入気流の流入角が前縁１０ａの設計入口角より小さくなった際に、羽根１０の前縁１０ａに丸みを有する翼型の効果がより発揮され羽根１０の負圧面側１１ｃでの剥離を抑えるが、羽根１０の外周側１０ｄでは流入気流が集まりほぼ安定した流入流れとなるので、外周側１０ｄの羽根入口角の最適化により外周側１０ｄでは前縁１０ａでの流入気流の流入角と前縁１０ａの設計入口角が大きく異ならないため、翼型の剥離改善効果が小さくかつ翼型の作用により羽根１０の負圧面側１１ｄ近傍の流速が増速され（均一薄肉に対する増速）、羽根１０の吐出側１０ｂから羽車８外へ吐出される。

【００１３】しかし、元々、羽根１０の外周側１０ｄでは、回転による遠心力により内部の気流が外周側１０ｄに偏り、さらに、周速が速いため羽根１０によって気流に与える運動エネルギーが大きくため、羽根１０から吐出する気流の流速はハブ側１０ｃに比べ大幅に速く（図示せず）、吐出気流がファンガード６の線材を通過する際、吐出気流の乱れが大きく羽根１０の外周側１０ｄの後流のファンガード６から流体騒音が発生する。

【００１４】このことから、羽根１０の外周側１０ｄでは、羽根１０の断面形状が翼型であるため羽根１０の負圧面側１１ｄ近傍の流速が増速されると羽根１０の吐出側１０ｂの吐出気流がさらに増速され、吐出気流がファンガード６の線材を通過する際の吐出気流の乱れがさらに大きくなり、羽根１０の外周側１０ｄの後流のファンガード６からの流体騒音が増加する。

【００１５】よって、羽根車８の羽根１０を翼型化することにより送風機５単独の送風騒音の増加は抑えられるが、ファンガード６からの流体騒音が増加し、空気調和

機の室外機１としては逆に騒音が増加する。従って、空気調和機等の送風機において、羽根負圧面側での大きな剥離を抑え送風機の送風騒音の増加を抑えると共に、ファンガードから発生する流体騒音の増加も抑えることが要求されている。

【００１６】本発明は、空気調和機等の送風機において、羽根負圧面での大きな剥離を防ぐと共に、吐出気流の増速を抑え、送風機の送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑えることを目的とする。

【００１７】

【課題を解決するための手段】この課題を解決するために、本発明は、羽根車の羽根のハブ側の羽根断面形状を翼型とし、羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型状にすることにより、回転による遠心力により内部の気流が外周側に偏ることで、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果がより発揮され羽根の負圧面側での大きな剥離を抑え、、また、周速も小さいため、翼型により負圧面側で増速された吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さくなる。

【００１８】また、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないため、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないので、羽根吐出側の吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくならない。従って、送風機の羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑える空気調和機の室外送風機が得られる。

【００１９】

【発明の実施の形態】本発明の請求項１記載の発明は、モータと、前記モータに取り付けられたハブと、前記ハブの周囲に設けられた複数の羽根からなる羽根車と、前記羽根車の外周を囲むオリフィスと、吐出側に設けられたファンガードで構成され、前記羽根のハブ側の羽根断面形状を翼型とし、前記羽根の外周側の羽根断面形状を薄肉の平板状、あるいは薄肉の翼型状にしたものであり、回転による遠心力により内部の気流が外周側に偏ることで、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果がより発揮され、羽根の負圧面側での大きな剥離を抑え、また、周速も小さいため、翼型により負圧面側で増速された吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さい。

【００２０】また、羽根外周側では流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないため、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないので、羽根吐出側の吐出気流が増速されず、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくならない。従って、送風機の羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音の増加の両方を抑えるという作用を有する。

【００２１】請求項２記載の発明は、外周側の羽根の負圧面側に複数の略半球形状のディンプルを設けた請求項１記載の空気調和機等の送風機であり、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるため、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならないので、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも、羽根負圧面側を設けたディンプルの作用により負圧面側表面からの流れの剥離が十分抑制され、流れの乱れが抑えられ、かつ、羽根外周側の負圧面側近傍の流速も翼型形状のように増速しないので羽根吐出気流の流速も増加しない。

【００２２】そのため、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。従って、送風機の羽根負圧面側での剥離による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという作用を有する。

【００２３】請求項３記載の発明は、外周側の羽根の負圧面側に、リブレットを設けた請求項１記載の空気調和機等の送風機であり、羽根外周側に流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により外周側前縁での流入気流の流入角と前縁の設計入口角が大きく異ならず、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも、前縁の負圧面側で流れの剥離が抑制され、さらに、羽根外周側の負圧面に設けたリブレットにより羽根車の回転の遠心力により羽根負圧面側近傍の乱流境界層が外周側に集積し摩擦抵抗増大により乱流境界層が増速せず、乱れも抑えられる。

【００２４】そのため、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。従って、送風機の羽根負圧面側での剥離及び乱流境界層の発達によるの送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという作用を有する。

【００２５】

【実施例】以下、本発明の実施例について図１～図１２を用いて説明する。

【００２６】尚、従来例と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【００２７】（実施例１）図１～図５は本発明の実施例の空気調和機等の送風機を示す。図１～図５において、

１２は、羽根車８のハブ８ａの周囲に設けられた複数の羽根であり、ハブ側１２ｃの同一半径の円筒断面における羽根１２の断面形状が羽根１２前縁１２ａに丸みを持つ翼型であり、外周側１２ｄの同一半径の円筒断面における羽根１２の断面形状が薄肉の板状であり、ハブ側１２ｃから外周側１２ｄへの羽根１２の断面形状の変化は、ハブ側１２ｃから半径方向の略中央にかけ漸次翼型の肉厚を薄くし、半径方向の略中央から外周側１２ｄにかけては略均一の肉厚の薄肉の平板状である。

【００２８】この構成により、羽根車８の回転による遠心力により羽根車８内部の気流が外周側１２ｄに偏り、ハブ側１２ｃでは流入角が安定しない不安定な流入流れに対し、羽根１２の前縁１２ａに丸みを有する翼型の効果がより発揮され、図４で示すように羽根の負圧面側１３ｃでの大きな剥離を抑え、また、周速も小さいため、翼型により負圧面側１３ｃで増速された吐出流れがファンガード６にて乱れを増加させる影響も外周側１２ｄに比べ遥かに小さい。

【００２９】また、図５で示すように、羽根１２の外周側１２ｄでは流入気流が集まりほぼ安定した流入流れとなるので、羽根１２の入口角の最適化により外周側１２ｄの前縁１２ａでの流入気流の流入角と前縁１２ａの設計入口角が大きく異ならないため、羽根１２の外周側１２ｄの薄肉の平板形状でも設計の最適化により流れが大きく剥離せず、かつ、羽根１２の負圧面側１３ｄ近傍の流速が増速されないので、羽根１２の吐出側１２ｂの吐出気流が増速されず、吐出気流がファンガード６の線材を通過する際の吐出気流の乱れが大きくならない。

【００３０】従って、送風機５の羽根１２の負圧面側１３ｃ、１３ｄでの大きな剥離による送風騒音の増加とファンガード６から発生する流体騒音の増加の両方を抑える。

【００３１】（実施例２）図６～図８は本発明の実施例２の空気調和機等の送風機を示す。尚、実施例１と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【００３２】１４は、羽根１２の半径方向の略中央から外周側１２ｄの負圧面側１３ｄに設けた複数の略半球形状のディンプルである。

【００３３】この構成により、図８で示すように、羽根１２の外周側１２ｄに流入気流が集まりほぼ安定した流入流れとなるので、羽根１２の入口角の最適化により羽根１２の外周側１２ｄの前縁１２ａでの流入気流の流入角と前縁１２ａの設計入口角が大きく異ならず、羽根１２の外周１２ｄの薄肉の平板形状でも、羽根１２の負圧面側１３ｄにおいて複数のディンプル１４の作用により負圧面側１３ｄの表面からの流れの剥離が抑制されるので、流れの乱れが抑えられ、かつ、羽根１２の負圧面側１３ｄ近傍の流速も羽根１２の翼型の断面形状の場合のように増速しないので、羽根１２の外周側１２ｄの吐出気流の流速も増加しない。

【００３４】そのため、吐出気流がファンガード６の線材を通過する際の吐出気流の乱れが低減される。従って、送風機５の羽根１２の負圧面側１３ｃ、１３ｄでの剥離による送風騒音の増加を抑制するとファンガード６から発生する流体騒音が低減する。

【００３５】（実施例３）図９～図１２は本発明の実施例３の空気調和機等の送風機を示す。尚、実施例１と同一構成の部分については重複をさけるため、同一符号を付けて説明を省略する。

【００３６】１５は、羽根１２の半径方向の略中央から外周側１２ｄの負圧面側１３ｄに設けた複数のリブレット（回転方向に対する縦溝）である。

【００３７】この構成により、図１２で示すように、羽根１２の外周側１２ｄに流入気流が集まりほぼ安定した流入流れとなるので、羽根１２の入口角の最適化により羽根１２の外周側１２ｄの前縁１２ａでの流入気流の流入角と前縁１２ａの設計入口角が大きく異ならず、羽根１２の外周１２ｄの薄肉の平板状の羽根断面形状でも前縁１２ａの負圧面側１３ｄで流れの剥離が抑制され、さらに、負圧面側１３ｄに設けたリブレット１５により、羽根車８の回転の遠心力による羽根１２の負圧面側１３ｄ近傍の乱流境界層が外周側１２ｄに集積し摩擦抵抗の増大により乱流境界層が発達するのを抑制するので、羽根１２が翼型形状の場合のように羽根１２の吐出側１２ｂからの吐出気流が増速せず、乱れも抑えられる。

【００３８】そのため、吐出気流がファンガード６の線材を通過する際の吐出気流の乱れが低減される。従って、送風機５の羽根１２の負圧面側１３ｃ、１３ｄでの剥離による送風騒音の増加と羽根１２の外周側１２ｄの負圧面側１３ｄでの乱流境界層の発達による送風騒音の増加を抑制すると共に、ファンガード６から発生する流体騒音が低減する。

【００３９】

【発明の効果】以上のように本発明によれば、羽根車の回転による遠心力により羽根車内部の気流が羽根の外周側に偏るため、ハブ側では流入角が安定しない不安定な流入流れに対し、羽根前縁に丸みを有する翼型の効果により羽根の負圧面側での大きな剥離を抑え、また、周速も小さいため、翼型化による負圧面側での増速した吐出流れがファンガードにて乱れを増加させる影響も外周側に比べ遥かに小さい。

【００４０】また、外周側では、流入気流が集まりほぼ安定した流入流れとなるので、羽根入口角の最適化により薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも流れが大きく剥離せず、かつ、羽根負圧面側近傍の流速が増速されないので、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが大きくならない。

【００４１】従って、羽根負圧面側での大きな剥離による送風騒音の増加とファンガードから発生する流体騒音

の増加の両方を抑えるという有利な効果が得られる。

【００４２】また、外周側において薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも羽根負圧面側にてディンプルの作用により負圧面側表面からの流れの剥離が抑制され、流れの乱れが抑えられ、かつ、羽根負圧面側近傍の流速も翼型形状のように増速しないので吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。

【００４３】従って、羽根負圧面側での剥離による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという有利な効果が得られる。

【００４４】また、羽根外周側において、薄肉の平板状、あるいは薄肉の翼型状の羽根断面形状でも設計の最適化により前縁の負圧面側で流れの剥離が抑制され、さらに、羽根外周部の負圧面側に設けたリブレットにより乱流境界層が発達するのを抑制するので、吐出気流がファンガードの線材を通過する際の吐出気流の乱れが低減される。

【００４５】従って、羽根負圧面側での剥離及び乱流境界層の発達による送風騒音の増加を抑制すると共に、ファンガードから発生する流体騒音が低減するという有利な効果が得られる。

【図面の簡単な説明】

【図１】本発明の実施例１における空気調和機等の送風機の断面図

【図２】本発明の実施例１における空気調和機等の送風機の正面図

【図３】本発明の実施例１における空気調和機等の送風機のＸ－Ｘ断面図

【図４】本発明の実施例１における空気調和機等の送風機のハブ側（Ａ－Ａ）円筒断面展開図

【図５】本発明の実施例１における空気調和機等の送風機の外周側（Ｂ－Ｂ）円筒断面展開図

【図６】本発明の実施例２における空気調和機等の送風＊機の正面図

【図７】本発明の実施例２における空気調和機等の送風機のハブ側（Ａ－Ａ）円筒断面展開図

【図８】本発明の実施例２における空気調和機等の送風機の外周側（Ｂ－Ｂ）円筒断面展開図

【図９】本発明の実施例３における空気調和機等の送風機の正面図

【図１０】本発明の実施例３における空気調和機等の送風機のＸ－Ｘ断面図

【図１１】本発明の実施例３における空気調和機等の送風機のハブ側（Ａ－Ａ）円筒断面展開図

【図１２】本発明の実施例３における空気調和機等の送風機の外周側（Ｂ－Ｂ）円筒断面展開図

【図１３】従来の空気調和機の室外機の断面図

【図１４】従来の空気調和機の室外機に用いられる送風機の正面図

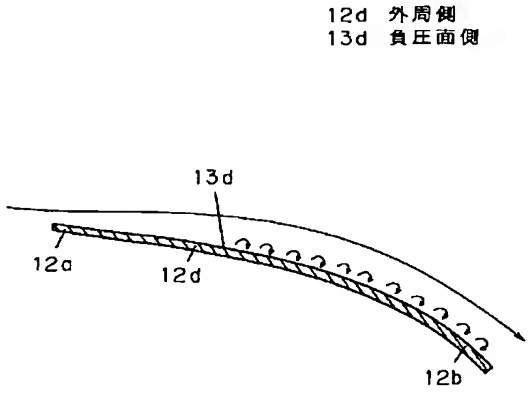
【図１５】従来の空気調和機の室外送風機のハブ側（Ａ－Ａ）円筒断面展開図

【図１６】従来の空気調和機の室外送風機の外周側（Ｂ－Ｂ）円筒断面展開図

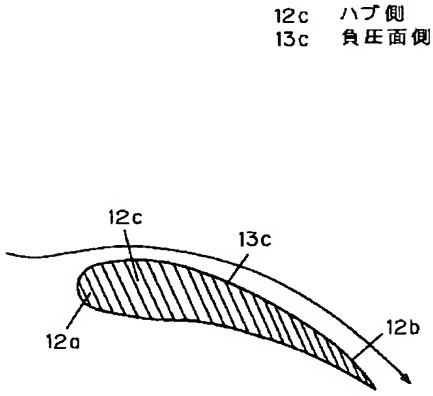
【符号の説明】

５　送風機
６　ファンガード
７　モータ
８　羽根車
８ａ　ハブ
９　オリフィス
１２　羽根
１２ｃ　ハブ側
１２ｄ　外周側
１３ｃ，１３ｄ　負圧面側
１４　ディンプル
１５　リブレット

【図５】

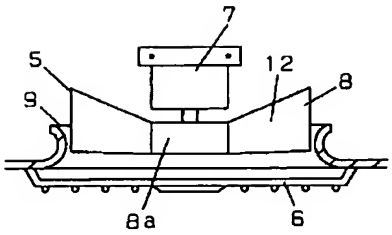


【図７】



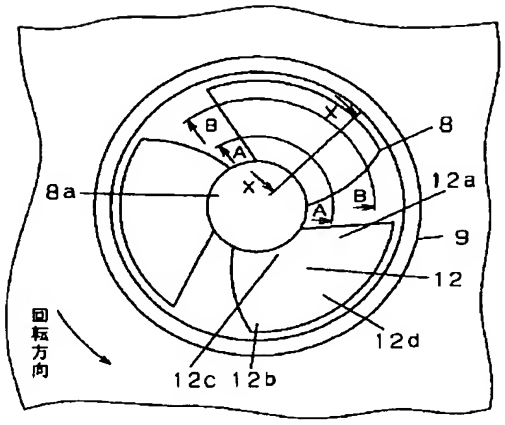
【図１】

５ 送風機
６ ファンガード
７ モータ
８ 羽根車
８ａ ハブ
９ オリフィス
１２ 羽根



【図２】

８ 羽根車
８ａ ハブ
９ オリフィス
１２ 羽根
１２ｃ ハブ側
１２ｄ 外周側

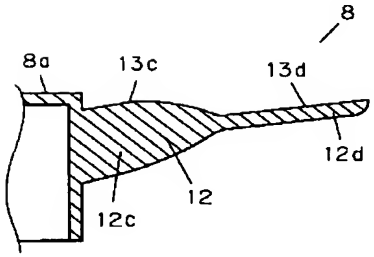


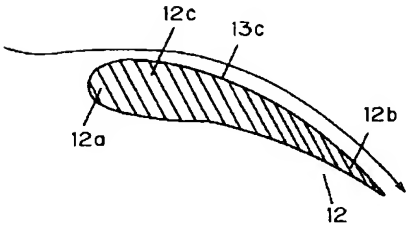
【図３】

８ 羽根車
８ａ ハブ
１２ 羽根
１２ｃ ハブ側
１２ｄ 外周側
１３ｃ，１３ｄ 負圧面側

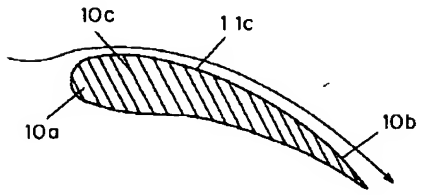
【図４】

１２ｃ ハブ側
１３ｃ 負圧面側

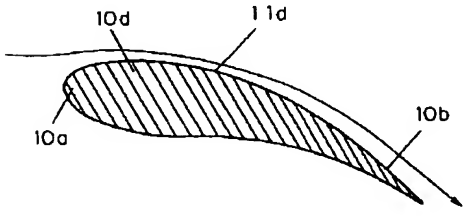




【図１５】

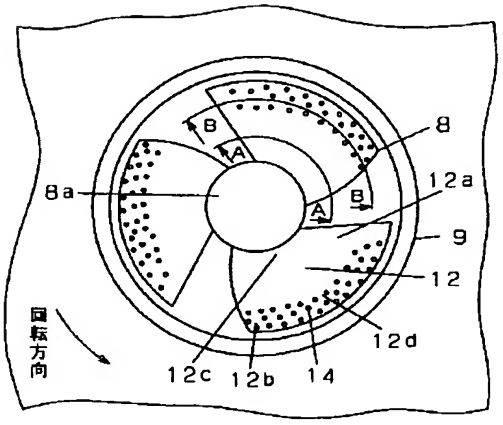


【図１６】



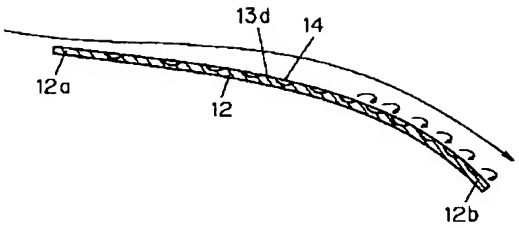
【図６】

８　羽根車
８ａ　ハブ
９　オリフィス
１２　羽根
１２ｃ　ハブ側
１２ｄ　外周側
１４　ディンプル



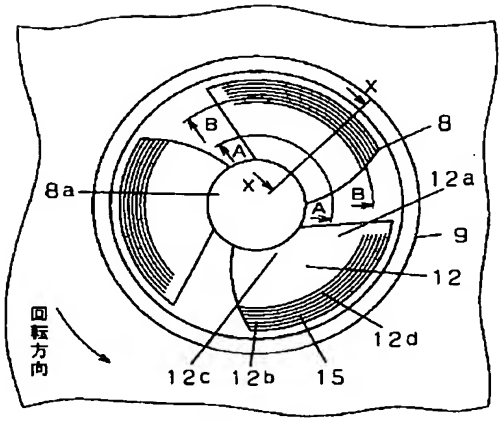
【図８】

１２ｄ　外周側
１３ｄ　負圧面側
１４　ディンプル



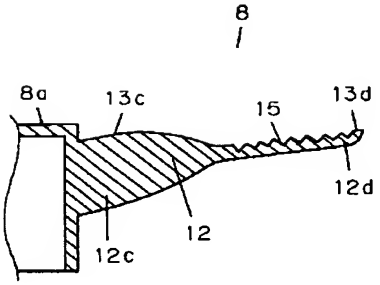
【図９】

８　羽根車
８ａ　ハブ
９　オリフィス
１２　羽根
１２ｃ　ハブ側
１２ｄ　外周側
１５　リブレット



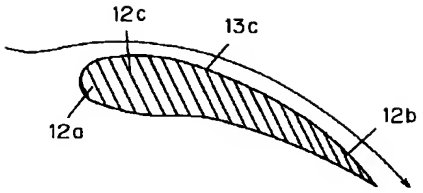
【図１０】

８　羽根車
８ａ　ハブ
１２　羽根
１２ｃ　ハブ側
１２ｄ　外周側
１３ｃ，１３ｄ　負圧面側
１５　リブレット



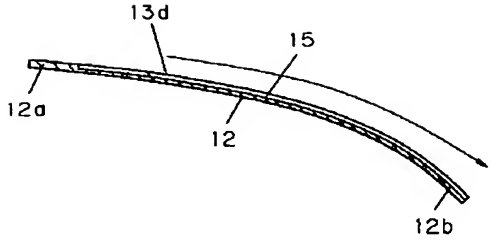
【図１１】

12c　ハブ側
13c　負圧面側

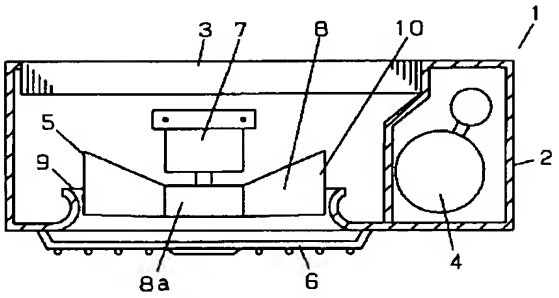


【図１２】

12d　外周側
13d　負圧面側
15　リブレット



【図１３】



【図１４】